A set of formal drawings is hereby submitted for the Examiner's approval. A formal set of drawings has also been sent to the Official Draftsperson for review.

Objections To The Specification

The abstract and the specification are objected to for various informalities.

Corrections have been made to alleviate the Examiner's objections.

Objections To The Claims

Claims 2-3 and 16-20 are objected to for various informalities.

Claims 2-3 and 16-20 have been amended to alleviate the Examiner's objections.

Claim Rejections Under 35 USC §112

Claims 3, 5, 9-10, 12 and 17-19 are rejected under 35 USC §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter

which Applicants regard as the invention. Various terms used in these claims are objected to by the Examiner.

Claim 17 has been cancelled and withdrawn from further consideration by the Examiner.

Claims 3, 5, 9-10, 12 and 18-19 have been amended to alleviate the Examiner's rejections. A reconsideration for allowance of these claims is respectfully requested of the Examiner.

Claim Rejections Under 35 USC §102

Claims 16, 17 and 20 are rejected under 35 USC §102(b) as being anticipated by Moslehi '745. It is contended that Moslehi discloses the invention essentially as claimed.

Claim 17 has been cancelled and withdrawn from further consideration by the Examiner.

The rejection of claims 16 and 20 under 35 USC §102(b) based on Moslehi is respectfully traversed.

Claim 16 has been amended to further include the recitation of:

> "at least two linear grooves formed in radial directions emanating from a center of said top surface **in fluid communication with each and everyone of said at least three circular grooves** for flowing a cooling fluid therethrough ..."

The Applicants respectfully submit that Moslehi does not teach or disclose the elements of at least three circular grooves and at least two linear grooves wherein the at least two linear grooves is in fluid communication with each and everyone of the at least three circular grooves. This is clearly shown in Moslehi's Figure 3 wherein the linear groove 90 only intersects (or in fluid communication)with the first two circular grooves 88. The linear groove 90 does not intersect and therefore, is not in fluid communication with the third circular groove 88. As such, the at least two linear grooves is not in fluid communication with each and everyone of the at least three circular grooves.

The rejection of claims 16 and 20 under 35 USC §102(b) based on Moslehi is respectfully traversed. A reconsideration for allowance of these claims is respectfully requested of the Examiner.

Claim Rejections Under 35 USC §103

Claims 1-3, 5, 8-10, 12-15 and 18-19 are rejected under 35 USC §103(a) as being unpatentable over Moslehi '745. It is contended that Moslehi discloses the invention essentially as claimed, including a plurality of circular concentric grooves 88 and a plurality of linear radial grooves 90, but does not specify the dimensions of the grooves 88 and 90, nor does it specifically show more than three circular grooves 88.

The rejection of claims 1-3, 5, 8-10, 12-15 and 18-19 under 35 USC §103(a) based on Moslehi is respectfully traversed.

In the newly amended independent claims 1, 8 and 16, the present invention specifically claims a second plurality of linear grooves (or at least two linear grooves) that are in fluid communication with each and everyone of the first plurality of circular grooves (or the at least three circular grooves). This is

clearly supported by the present invention Figure 3A, wherein the linear grooves 76 intersect (and therefore in fluid communication) with each and everyone of the circular grooves 74. The Applicants respectfully submit that such critical feature of the present invention structure is clearly not taught, discloses or suggested by Moslehi.

The rejection of claims 1-3, 5, 8-10, 12-15 and 18-19 under 35 USC §103(a) based on Moslehi is respectfully traversed. A reconsideration for allowance of these claims is respectfully requested of the Examiner.

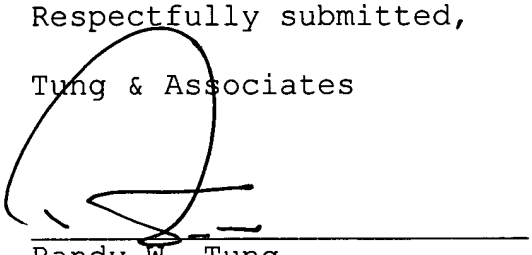
Based on the foregoing, the Applicants respectfully submit that all of the pending claims, i.e. claims 1-3, 5, 8-10, 12-16 and 18-20, are now in condition for allowance. Such favorable action by the Examiner at an early date is respectfully solicited.

Attached hereto is a marked-up version of the changes made to the specification, claims and abstract by the current amendment. The attached page is captioned "Version With Markings To Show Changes Made".

In the event that the present invention is not in a condition for allowance for any other reasons, the Examiner is respectfully invited to call the Applicants' representative at his Bloomfield Hills, Michigan office at (248) 540-4040 such that necessary action may be taken to place the application in a condition for allowance.

Respectfully submitted,

Tung & Associates



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RWT\kd
Enclosure: one set of formal dwgs

VERSION WITH MARKINGS TO SHOW CHANGES MADE

In The Specification

Paragraph beginning at line 12 of page 6 has been amended as follows:

- It is yet another further object of the present invention to provide a wafer pedestal that is effective in cooling a high temperature processed wafer that includes a pedestal that has a [groove] grooved surface including at least five circular grooves concentrically formed in the top surface and three linear grooves formed in radial directions emanating from a center of the top surface. -

Paragraph beginning at line 7 of page 11 has been amended as follows:

- In the novel cooling stage, the first plurality of circular grooves provided is at least three, and preferably at least five, while the second plurality of grooves provided is at least two, and preferably at least three. The dimensions of the grooves provided may be a width between about 1 mm and about 7 mm, and a depth between about 1 mm and about 7 mm, preferably a width between about 3 mm and about 5 mm, and a depth between about 1 mm and about 3 mm. The novel cooling stage may be advantageously situated in a cool-down chamber as part of a cluster tool for sputtering metal on a semiconductor wafer. The cooling stage may be advantageously used between a high temperature sputtering process and a low temperature sputtering process for the rapid and uniform cooling of a wafer from a high process temperature, i.e., 300°C, which is

frequently encountered in the sputtering of an aluminum/copper alloy. -

In The Abstract

Please amend the Abstract as follows:

-A cooling stage for a semiconductor substrate and a method for utilizing such cooling stage for improved cooling of a semiconductor substrate [are disclosed]. In the cooling stage, a pedestal that has a substantially planar top surface is equipped with a first plurality of circular grooves concentrically formed in the top surface and a second plurality of linear grooves formed in radial directions emanating from a center of the top surface in fluid communication with the first plurality of circular grooves to allow a cooling fluid to flow therethrough when a semiconductor substrate is positioned on the top surface of the stage. The apparatus and method are effective in preventing wafer jump or wafer sticking problems frequently caused

by an imbalance of thermal stresses in a top surface and a bottom surface of a wafer that is inadequately cooled on a cooling stage.-

In The Claims

Claim 17 has been cancelled and without prejudice.

Claim 1 has been amended as follows:

1. (Twice Amended) A cooling stage for a semiconductor substrate comprising:

a pedestal having a substantially planar top surface,

a first plurality of circular grooves concentrically formed in said top surface, and

a second plurality of linear grooves formed in radial directions emanating from a center of said top surface in fluid communication with each and everyone of said first plurality of circular grooves allowing a cooling fluid to flow therethrough when said semiconductor substrate is positioned on said top surface of the pedestal, said first plurality of circular grooves and said second plurality of linear grooves each having a width between about 1 mm and about 7 mm, and a depth between about 1 mm and about 7 mm.

Claim 2 has been amended as follows:

2. (Amended) A cooling stage for a semiconductor substrate according to claim 1, wherein said first plurality is at least [3] three and said second plurality is at least [2] two.

Claim 3 has been amended as follows:

3. (Amended) A cooling stage for a semiconductor substrate according to claim 1, wherein said first plurality is [preferably] at least [5] five and said second plurality is [preferably] at least [3] three.

Claim 5 has been amended as follows:

5. (Amended) A cooling stage for a semiconductor substrate according to claim 1, wherein said first plurality of circular grooves and said second plurality of linear grooves each having a width [preferably] between about 3 mm and about 5 mm, and a depth [preferably] between about 1 mm and about 3 mm.

Claim 8 has been amended as follows:

8. (Twice Amended) A method for cooling a semiconductor substrate comprising the steps of:

providing a cooling stage comprising a wafer pedestal equipped with a grooved top surface thereon, said grooved top surface comprises a first plurality of circular grooves concentrically formed in said top surface and a second plurality of linear grooves formed in radial directions emanating from a center of said top surface in fluid communication with each and everyone of said first plurality of circular grooves, said first plurality of circular grooves and said second plurality of linear grooves each having a width between about 1 mm and about 7 mm, and a depth between about 1 mm and about 7 mm,

positioning a heated semiconductor substrate on said grooved top surface,

flowing a cooling liquid through a cooling channel in said wafer pedestal to carry away heat transferred to said grooved top surface, and

flowing a cooling gas through said first and second plurality of circular and linear grooves to carry away heat from a backside of said heated semiconductor substrate.

Claim 9 has been amended as follows:

9. (Amended) A method for cooling a semiconductor substrate according to claim 8, wherein said [grooved top surface further] first plurality of circular grooves comprises at least [3] three circular grooves and said second plurality of linear grooves comprises at least [2] two linear grooves.

Claim 10 has been amended as follows:

10. (Amended) A method for cooling a semiconductor substrate according to claim 8, wherein said [grooved top surface] first plurality of circular grooves comprises [preferably] at least [5] five circular grooves and said second plurality of linear grooves comprises at least [3] three linear grooves.

Claim 12 has been amended as follows:

12. (Amended) A method for cooling a semiconductor substrate according to claim 8 further comprising the step of providing said grooved top surface with a plurality of circular and linear grooves, each [preferably] having a width between about 3 mm and about 5 mm, and a depth of between about 1 mm and about 3 mm.

Claim 16 has been amended as follows:

16. (Twice Amended) A wafer pedestal effective [in] for cooling a high temperature processed wafer comprising:

a wafer pedestal having a substantially planar top surface,

at least [3] three circular grooves concentrically formed in said top surface, and

at least [2] two linear grooves formed in radial directions emanating from a center of said top surface in fluid communication with each and everyone of said at least [3] three circular grooves for flowing a cooling fluid therethrough cooling the said high temperature processed wafer positioned thereon.

Claim 18 has been amended as follows:

18. (Amended) A wafer pedestal effective in cooling a high temperature processed wafer according to claim 16, wherein said [wafer pedestal preferably] at least three circular grooves comprises at least [5] five circular grooves and wherein said at least two linear grooves comprises at least [3] three linear grooves.

Claim 19 has been amended as follows:

19. (Amended) A wafer pedestal effective [in] for cooling a high temperature processed wafer according to claim 16 [further comprising 9] wherein said at least three circular grooves comprises nine circular grooves and [3] said at least two linear grooves comprises three linear grooves each having a width of about 2 mm and a depth of about 1 mm.

Claim 20 has been amended as follows:

20. (Amended) A wafer pedestal effective in cooling a high temperature processed wafer according to claim 16, wherein said cooling fluid [flown] flowing through said circular and said linear grooves is an inert gas selected from the group consisting of argon, nitrogen and helium.